

REMARKS

Claims 1-2, 4-16, 18-21, 23-30, 32-40, and 42-45 are amended, and claim 3 is canceled; as a result, claims 1-2 and 4-45 remain pending in this application.

Information Disclosure Statement

Applicant submitted an Information Disclosure Statement and a 1449 Form on August 30, 2005. Applicant respectfully requests that an initialed copy of the 1449 Form be returned to Applicant's Representatives to indicate that the cited references have been considered by the Examiner.

Specification

Applicant has amended the specification for clarity. In some instances typographical errors are corrected. Support for the clarification included on page 10, lines 9-13 can be found in Figs 1 and 3; page 12, line 27 - page 13, line 8; and page 18, lines 1-6. No new matter has been added.

Claims

The claims were amended for clarity and improving comprehension.

§103 Rejection of the Claims

Claims 1-37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shin et al. (U.S. 6,385,020) in view of Verhaverbeke et al. (U.S. 5,922,624).

Claims 38-45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shin et al. in view of Yang et al. (U.S. 6,727,155).

Claims 1-37 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Thakur et al. (U.S. 6,251,720) in view of Verhaverbeke et al.

Claims 38-45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Thakur et al. in view of Yang et al.

Applicant respectfully traverses the Examiners rejection of claims 1-45.

The Examiner has the burden under 35 U.S.C. 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). As part of establishing a *prima facie* case of obviousness, the Examiner must show that some objective teaching in the prior art or some knowledge generally available to one of ordinary skill in the art would lead an individual to combine the relevant teaching of the references. *Id.*

The court in *Fine* stated that:

Obviousness is tested by "what the combined teaching of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 878 (CCPA 1981)). But it "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." *ACS Hosp. Sys.*, 732 F.2d at 1577, 221 USPQ at 933. And "teachings of references can be combined *only* if there is some suggestion or incentive to do so." *Id.* (emphasis in original).

The M.P.E.P. adopts this line of reasoning, stating that:

"In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Appellant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991))". *M.P.E.P.* 2142.

I. All Claim Limitations are not found in the References, whether Alone or in Combination

Regarding Claims 1-2, and 4-37:

The Examiner has admitted Shin et al do not teach vapor phase etching or an etch initiator, but rather the Examiner relies on Verhaverbeke et al in combination with Shin et al. Applicant agrees that Shin et al do not teach vapor phase etching or etch initiator. The Examiner

has further admitted Thakur et al do not teach vapor phase etching or an etch initiator, but rather the Examiner again relies on Verhaverbeke et al in combination with Thakur et al. Applicant agrees that Thakur et al do not teach vapor phase etching or etch initiator.

Applicant believes the Examiner has misread Verhaverbeke et al. Verhaverbeke et al. disclose “[i]n order to achieve the intended aims, especially for semiconductor processing, the present invention *proposes* the use in the gaseous phase of mixtures of hydrogen fluoride and one or more carboxylic acids, possibly in admixture with water vapor, gases such as Ar, N₂, H₂, HCl or organic solvents such as alcohols, ketones, aldehydes and esters.” (col. 2, lines 36-43; emphasis added) “The main aims of the present invention are to provide HF formulated mixtures operating in the gas phase which are more reliable than previous mixtures and which have an etching behavior which is very reproducible, which achieve good electrical results with respect to the oxides grown on oxide stripped silicon surfaces and which provide a reproducible and uniform process for etching of thick oxide layers.” (col. 2, lines 21-28, supported by Tables 1-5 and further supported by the data shown in Figs. 1, 3, and 4). More particularly, Verhaverbeke et al show “that the process HF vapor/carboxylic acid process yield much more uniform and reproducible etching than the HF/H₂O process.” (col. 5, lines 16-18) “*The acetic acid only serves as catalyst.*” (col. 4, line 34; emphasis added) Applicant is unable to find any teaching of a surface tension lowering agent in Verhaverbeke et al.

The Examiner has effectively admitted that Verhaverbeke et al do not teach a surface tension lowering agent or as an etch initiator. But, the Office Action appears to maintain that Applicant’s claims 1-37 are inherent in Verhaverbeke et al because the Examiner stated “[o]ne would have been motivated to utilize such a vapor etching including a vapor that includes hydrogen fluorine (sic) (HF), an alcohol, a methanol, and specially carboxylic – that could functions as a surface tension lowering agent or as an etch initiator in view of the teachings in Verhaverbeke that such a vapor phase etching yields a much more reproducible product.” Applicant respectfully disagrees because the Office Action has not established a *prima facie* case of inherency because, as recited in MPEP § 2112, “In relying upon the theory of inherency, the examiner must provide basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of

the applied prior art,” citing Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original).

The Office Action only argued that Verhaverbeke et al disclose including vapor that could function as a surface tension lowering agent or as an etch initiator. Thus, the Office Action does not even assert that the allegedly inherent characteristic is necessary, let alone provide a basis in fact and/or technical reasoning.

To serve as an anticipation when a reference is silent about the asserted inherent characteristic, the gap in the reference may be filled with recourse to extrinsic evidence. But, such evidence must make clear that “the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.” *Continental Can Co. v. Monsanto Co.*, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). Applicant respectfully submits that the Examiner has not produced extrinsic evidence to show that the relevant elements recited in Applicant’s claims 1-37 is necessarily present in Verhaverbeke et al.

With respect to claim 1:

In contrast Applicant’s claim 1 recites, in part, “vapor phase etching a layer adjacent to the side wall of the memory container with a vapor including a surface tension lowering agent.” Applicant is unable to find any teaching of a surface tension lowering agent in the Verhaverbeke disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant’s claimed invention.

With respect to claim 2, and 4-6:

Claims 2, and 4-6 are dependent on claim 1 and incorporate all its elements. Therefore, Applicant’s claims 2, and 4-6 are distinct from and non-obvious with respect to Shin et al, Thakur et al, and Verhaverbeke et al for at least the reasons stated above.

With respect to claim 7:

In contrast Applicant’s claim 7 recites, in part, “etching a layer adjacent to a side wall of the double-sided capacitor memory container with vapor comprising vapor for reducing surface

tension that includes methanol.” Applicant is unable to find any teaching of a vapor for reducing surface tension in the Verhaverbeke disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant’s claimed invention.

With respect to claim 8-10:

Claims 8-10 are dependent on claim 7 and incorporate all its elements. Therefore, Applicant’s claims 8-10 are distinct from and non-obvious with respect to Shin et al, Thakur et al, and Verhaverbeke et al for at least the reasons stated above.

With respect to claim 11:

In contrast Applicant’s claim 11 recites, in part, “vapor phase etching a layer adjacent to a side wall of the double-sided capacitor container with a vapor that includes hydrogen fluoride, an etch initiator composition and a surface tension lowering composition that includes an alcohol.” Applicant is unable to find any teaching of a surface tension lowering composition in the Verhaverbeke disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant’s claimed invention.

With respect to claim 12-15:

Claims 12-15 are dependent on claim 11 and incorporate all its elements. Therefore, Applicant’s claims 12-15 are distinct from and non-obvious with respect to Shin et al, Thakur et al, and Verhaverbeke et al for at least the reasons stated above.

With respect to claim 16:

In contrast Applicant’s claim 16 recites, in part, “vapor phase etching an insulator layer formed adjacent to a double-sided capacitor container in the integrated circuit with a vapor including a surface tension lowering agent, wherein the vapor phase etching of the insulator layer comprises inserting a vapor comprised of a hydrogen fluoride and isopropyl alcohol into the vapor etch chamber.” Applicant is unable to find any teaching of a surface tension lowering

agent in the Verhaverbeke disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant's claimed invention.

With respect to claim 17-20:

Claims 17-20 are dependent on claim 16 and incorporate all its elements. Therefore, Applicant's claims 17-20 are distinct from and non-obvious with respect to Shin et al, Thakur et al, and Verhaverbeke et al for at least the reasons stated above.

With respect to claim 21:

In contrast Applicant's claim 21 recites, in part, "mixing a hydrogen fluoride with a vapor including a surface tension lowering agent including isopropyl alcohol to form a mixed vapor." Applicant is unable to find any teaching of a surface tension lowering agent in the Verhaverbeke disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant's claimed invention.

With respect to claim 22-25:

Claims 22-25 are dependent on claim 21 and incorporate all its elements. Therefore, Applicant's claims 22-25 are distinct from and non-obvious with respect to Shin et al, Thakur et al, and Verhaverbeke et al for at least the reasons stated above.

With respect to claim 26:

In contrast Applicant's claim 26 recites, in part, "mixing an etch initiator composition and surface tension reducing composition including hydrogen fluoride and alcohol to form a mixed vapor." Applicant is unable to find any teaching of a surface tension reducing composition in the Verhaverbeke disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant's claimed invention.

With respect to claim 27-30:

Claims 27-30 are dependent on claim 26 and incorporate all its elements. Therefore, Applicant's claims 27-30 are distinct from and non-obvious with respect to Shin et al, Thakur et al, and Verhaverbeke et al for at least the reasons stated above.

With respect to claim 31:

In contrast Applicant's claim 31 recites, in part, "forming a vapor that includes an H₂O vapor, an HF gas and a surface tension lowering agent." Applicant is unable to find any teaching of a surface tension lowering agent in the Verhaverbeke disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant's claimed invention.

With respect to claim 32-37:

Claims 32-37 are dependent on claim 31 and incorporate all its elements. Therefore, Applicant's claims 32-37 are distinct from and non-obvious with respect to Shin et al, Thakur et al, and Verhaverbeke et al for at least the reasons stated above.

Regarding Claims 38-45:

The Examiner has admitted Shin et al do not teach vapor phase etching or an etch initiator, but rather the Examiner relies on Yang et al in combination with Shin et al. Applicant agrees that Shin et al do not teach vapor phase etching or etch initiator. The Examiner has further admitted Thakur et al do not teach vapor phase etching or an etch initiator, but rather the Examiner again relies on Yang et al in combination with Thakur et al. Applicant agrees that Thakur et al do not teach vapor phase etching or etch initiator.

The part of Yang et al cited by the Examiner states "[t]he present invention spin mode acid vapor wet etch method replaces the conventional plasma dry etch method and thus prevents damages from occurring to the silicon surface at the source/drain areas." (col. 4, lines 23-26)

With respect to claim 38:

In contrast Applicant's claim 38 recites, in part, "removing at least a part of the BPSG material based on a vapor wet etch operation with a vapor including a surface tension lowering agent comprising hydrogen fluoride and alcohol." Applicant is unable to find any teaching of a surface tension lowering agent in the Yang disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant's claimed invention.

With respect to claim 39-40:

Claims 39-40 are dependent on claim 38 and incorporate all its elements. Therefore, Applicant's claims 39-40 are distinct from and non-obvious with respect to Shin et al and Yang et al, and with respect to Thakur et al and Yang et al for at least the reasons stated above.

With respect to claim 41:

In contrast Applicant's claim 41 recites, in part, "vapor wet etching of a layer of the oxide with a vapor comprised of hydrogen fluoride, an etch initiator composition and a surface tension lowering agent." Applicant is unable to find any teaching of a surface tension lowering agent in the Yang disclosure. The Examiner admits Shin et al and Thakur et al do not teach vapor phase etching. Therefore, none of the applied references, either or alone or in combination, teach all elements of Applicant's claimed invention.

With respect to claim 42-45:

Claims 42-45 are dependent on claim 41 and incorporate all its elements. Therefore, Applicant's claims 42-45 are distinct from and non-obvious with respect to Shin et al and Yang et al, and with respect to Thakur et al and Yang et al for at least the reasons stated above.

II. There is No Objective Evidence showing a Motivation or Suggestion to Combine Disclosures

Applicant respectfully traverses the Examiner's assertion of obviousness with respect to vapor phase etching as claimed by Applicant, and in particular to surface tension lowering and an

etch initiator, and further with respect to the motivation “to utilize said vapor phase etching that includes hydrogen fluoride, an alcohol, a methanol, and specially carboxylic in view of the teachings in Verhaverbeke et al.” Applicant further respectfully traverses the Examiner’s assertion of obviousness with respect to the motivation “to utilize such a vapor wet etching in view of the teachings in Yang that such a vapor wet etching prevents damages from occurring to an adjacent material layer.”

Regarding Shin et al and Verhaverbeke et al:

Shin et al address nonuniform thinning of U-shaped patterns caused by a migration of silicon atoms within the U-shaped patterns due to formation of HSGs. Thinning causes the U-shaped patterns to be more susceptible to fracture and breaking. (see col. 2, lines 28-31 referencing col. 2, lines 16-21) Shin et al address HSG grain size in relation to capacitance. (see Abstract and Summary of Invention)

Verhaverbeke et al disclose providing HF formulated mixtures operating in the gas phase which are more reliable than previous mixtures, particularly with respect to etching thick oxide layers. (col. 2, lines 21-28) Verhaverbeke et al address etching reproducibility of oxides etched with HF/water vapor.

Shin et al do not mention or suggest etching of capacitive structures, but rather HSG grain size in relation to capacitance, and Verhaverbeke et al do not mention or suggest capacitors or HSG, but rather etching reproducibility of oxides. Therefore, there is no objective motivation or suggestion to combine Shin et al and Verhaverbeke et al for surface tension control. Applicant traverses the basis for combining as a mere hindsight reconstruction of the Applicant’s claimed invention.

Regarding Thakur et al and Verhaverbeke et al:

Thakur et al address increasing capacitance per unit area utilizing HDC material (col. 3, lines 5-9) that is as thin and dense as possible in order to conserve device density (col. 3, lines 13-17). Thakur et al focus on using HDC in relation to capacitance. (see for example, Summary of Invention)

Verhaverbeke et al disclose providing HF formulated mixtures operating in the gas phase which are more reliable than previous mixtures, particularly with respect to etching thick oxide layers. (col. 2, lines 21-28) Verhaverbeke et al address etching reproducibility of oxides etched with HF/water vapor.

Thakur et al do not mention or suggest etching of capacitive structures, but rather HDC in relation to capacitance, and Verhaverbeke et al do not mention or suggest capacitors or HDC, but rather etching reproducibility of oxides. Therefore, there is no objective motivation or suggestion to combine Thakur et al and Verhaverbeke et al for surface tension control. Applicant traverses the basis for combining as a mere hindsight reconstruction of the Applicant's claimed invention.

Regarding Shin et al, Thakur et al, and Yang et al:

Yang et al disclose a method for etching side wall spacers without causing plasma damage. (col. 2, lines 4-49, and col. 2, lines 52-56) Shin et al address nonuniform thinning of U-shaped patterns caused by a migration of silicon atoms within the U-shaped patterns due to formation of HSGs. Thinning causes the U-shaped patterns to be more susceptible to fracture and breaking. (see col. 2, lines 28-31 referencing col. 2, lines 16-21) Shin et al focus on HSG grain size in relation to capacitance. (see Abstract and Summary of Invention) Thakur et al disclose increasing capacitance per unit area utilizing HDC material (col. 3, lines 5-9) that is as thin and dense as possible in order to conserve device density (col.3, lines 13-17). Thakur et al focus on using HDC in relation to capacitance. (see for example, Summary of Invention)

Neither Shin et al nor Thakur et al mention or suggest etching of capacitive structures, and the Yang et al do not mention or suggest capacitors or HDC or HSG. Therefore, there is no objective motivation or suggestion to combine Shin et al or Thakur et al with Yang et al for surface tension control. Applicant traverses the basis for combining as a mere hindsight reconstruction of the Applicant's claimed invention.

Based at least on the above, Applicant requests withdrawal of all rejections and allowance of all claims.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 23 day of January, 2006.

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